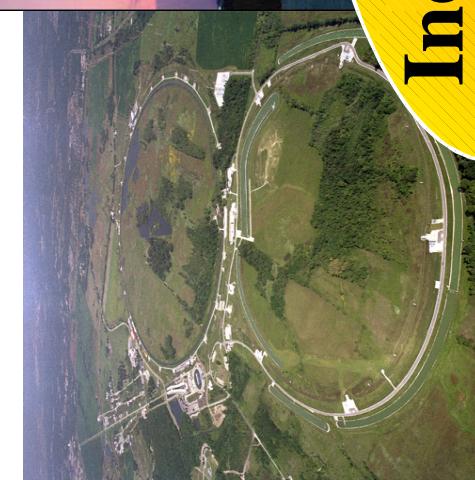
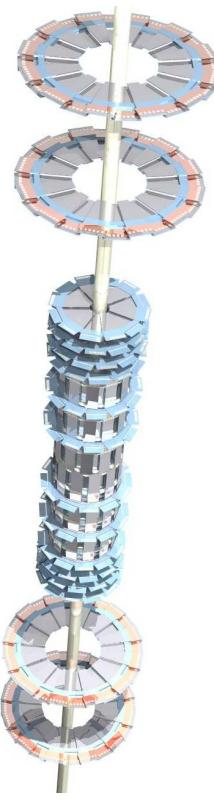




Inclusive B Lifetime at DØ

Edward De La Cruz Burelo
Cinvestav, México
DØ Collaboration





The Tevatron is a B factory



- All species $B^0, B^+, B_s^0, B_c^+, \Lambda_b^0$ produced @ Tevatron
- Large rate:

$$\sigma(p\bar{p} \rightarrow b\bar{b}) \approx 170 \text{ }\mu\text{b at } 2 \text{ TeV}$$

$$\sigma(e^+e^- \rightarrow b\bar{b}) \approx 7 \text{ nb at } Z^0$$

$$\sigma(e^+e^- \rightarrow b\bar{b}) \approx 1 \text{ nb at } Y(4S)$$

- Inclusive lifetime measurement

- Used to separate and study:

$$p\bar{p} \rightarrow J/\psi X$$

$$p\bar{p} \rightarrow b\bar{b} \rightarrow J/\psi X$$

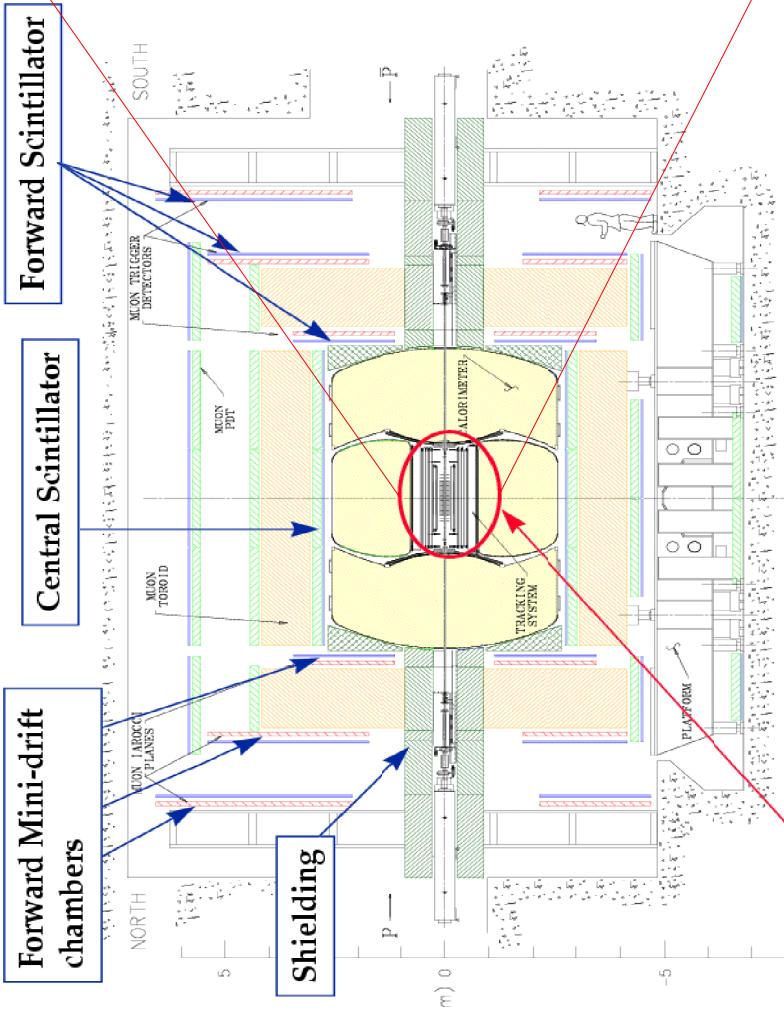
- Very large sample for calibrating/verifying proper time reconstruction



The DØ Detector



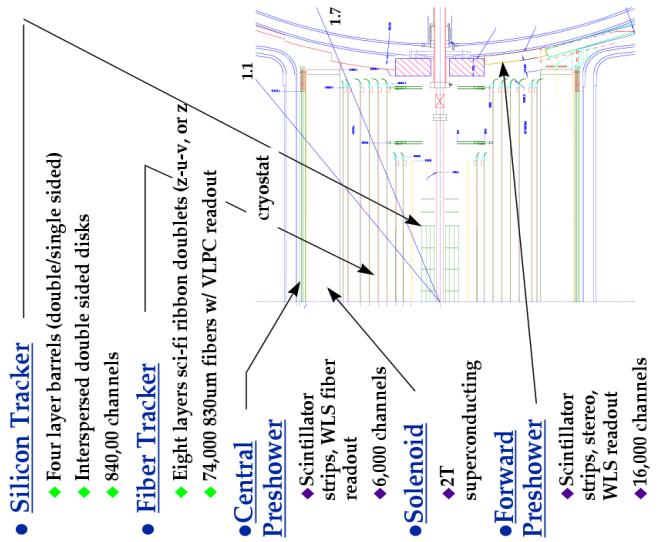
Forward Mini-drift chambers



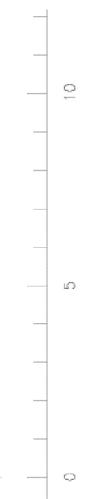
Forward Scintillator

Central Scintillator

The DØ Upgrade - Tracking



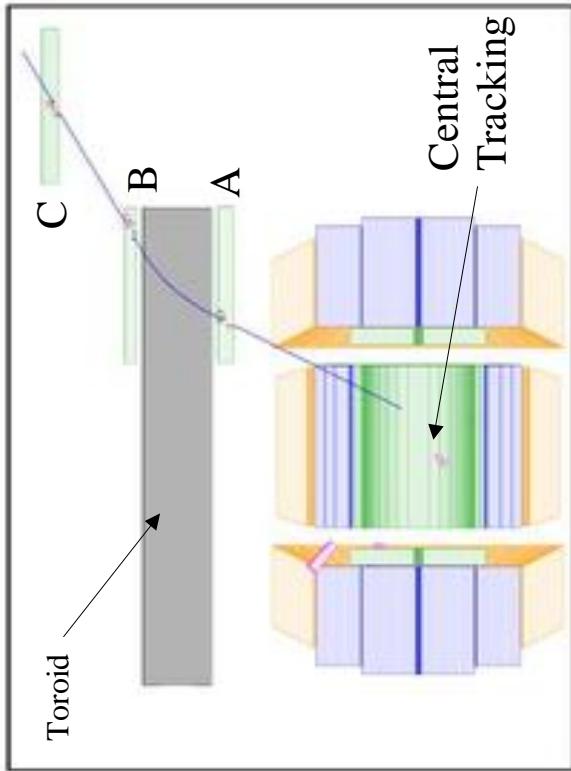
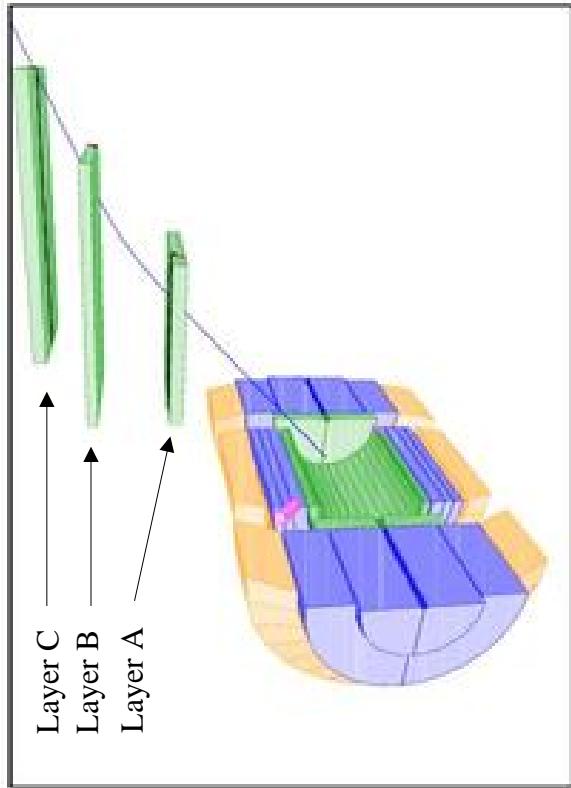
New Solenoid, Tracking System
Si, SciFi,Preshowers



+ New Electronics, Trig, DAQ



Muon ID



$\epsilon(\mu \text{ id}) \sim 90\%$

■ Muon trigger:



$\epsilon(\text{track}) \times \epsilon(\text{match}) \sim 83\%$

Level 3

Level 2

Level 1



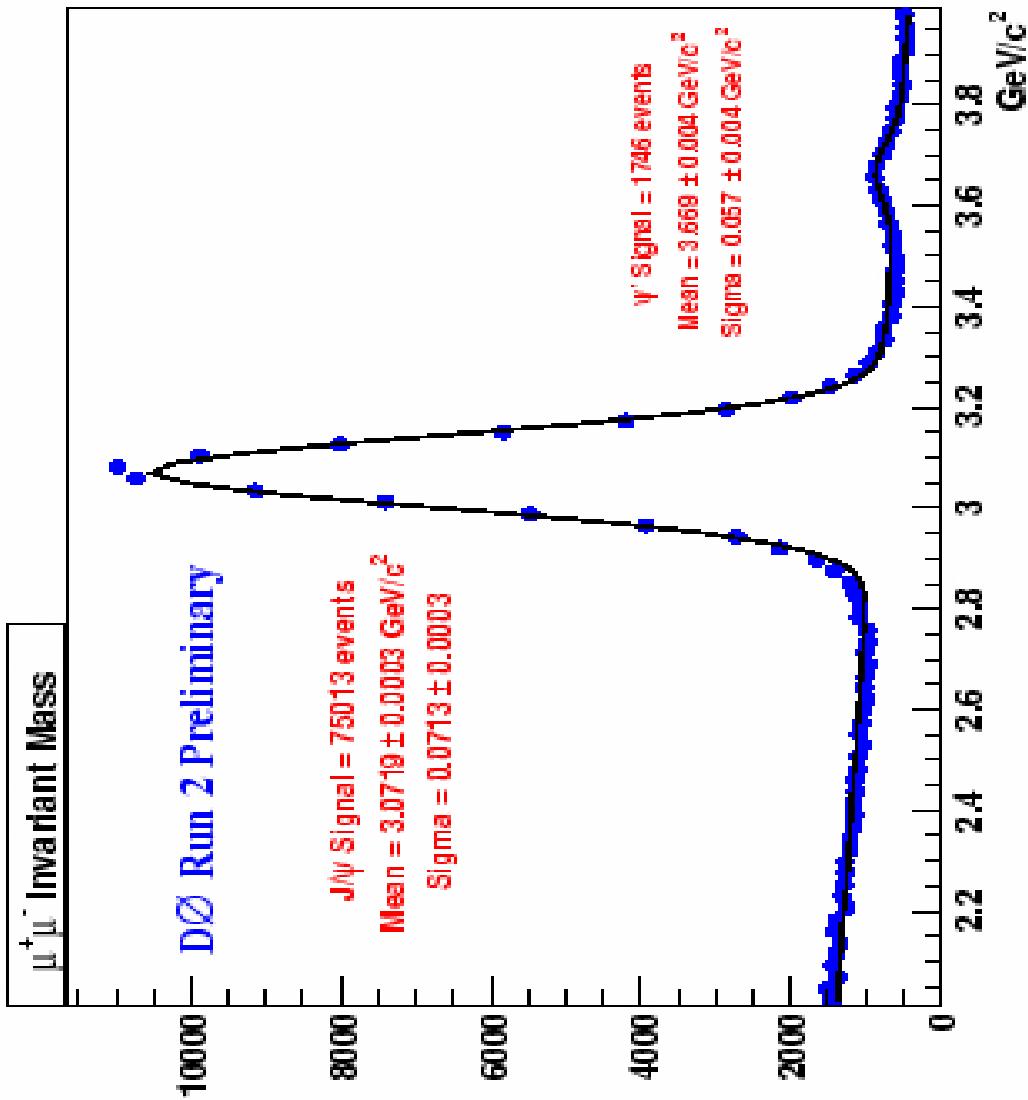
J/ ψ Sample



J/ $\psi \rightarrow \mu^+ \mu^-$

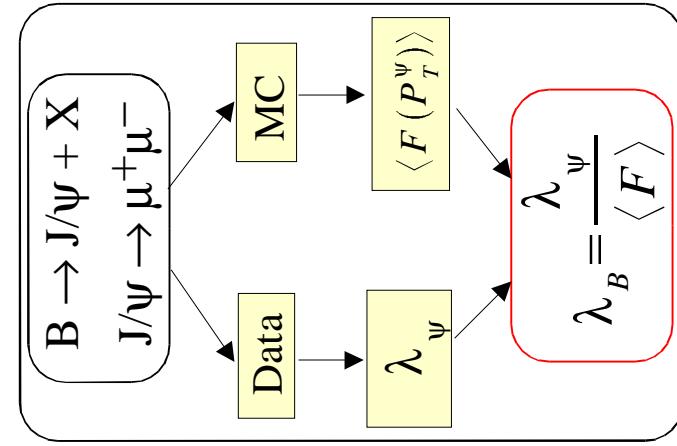
- Selection cuts:
 - J/ ψ pT > 3.0 GeV/c²
 - Muon pT > 1.5 GeV/c²
 - Silicon hits >3
 - Fiber tracker hits >4

L \sim 40 pb⁻¹



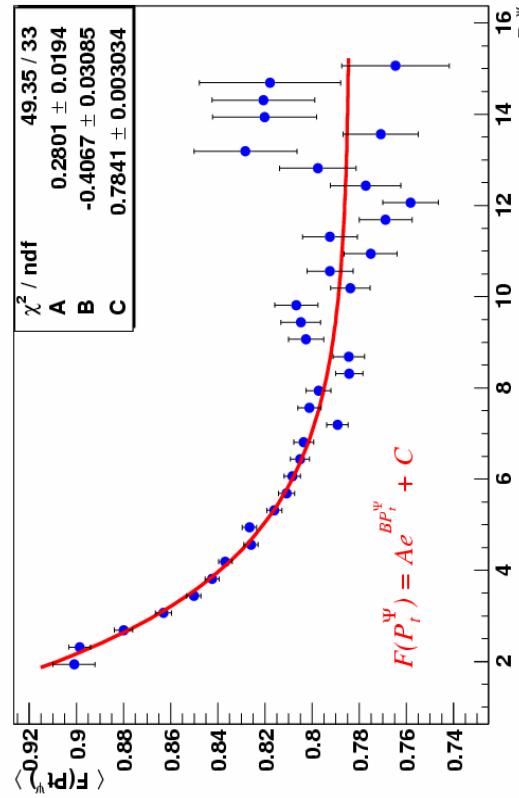
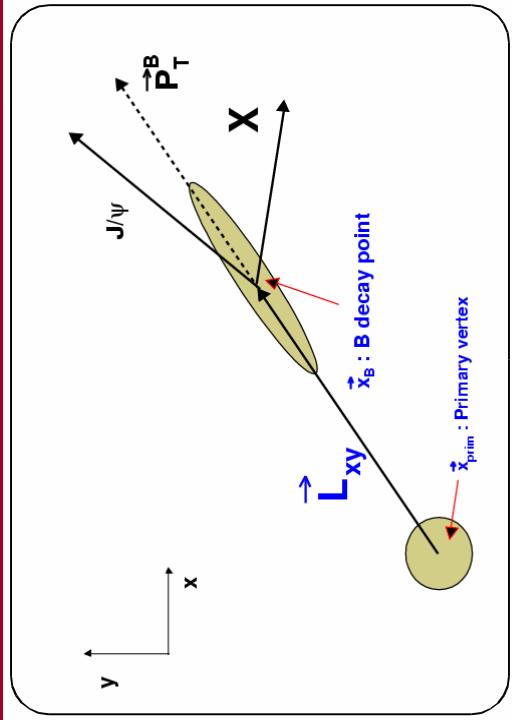


Inclusive B Lifetime Measurement



$$\lambda_B = Lxy \frac{M_\psi}{P_T^\psi \langle F \rangle}$$

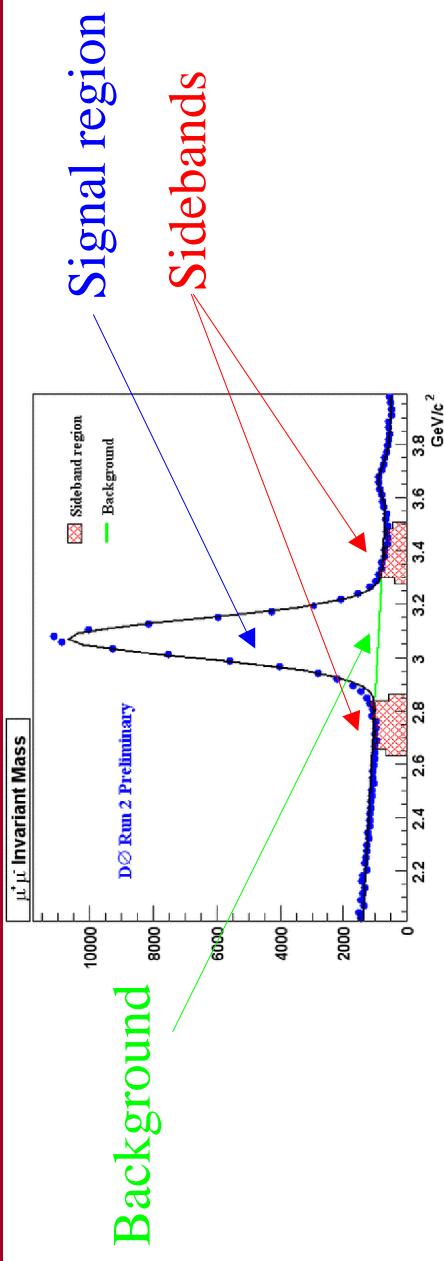
$$F(P_T^\psi) = \frac{\lambda_\psi}{\lambda_B}$$



(Correction Factor obtained from MC: Pythia + QQ, Run I
CDF-tuned parameters)



Lifetime distribution

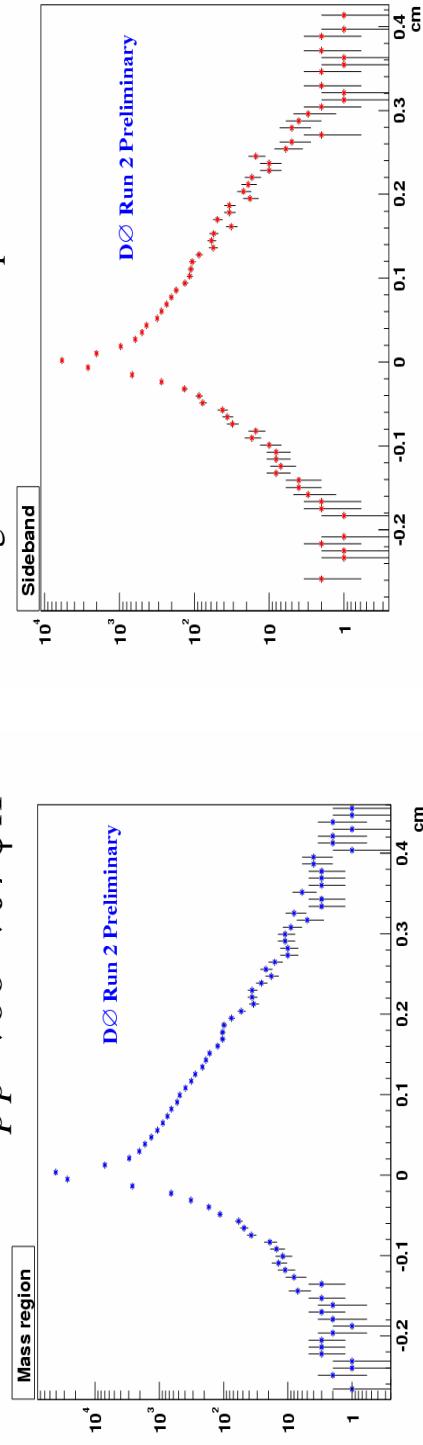


■ Signal:

Zero lifetime: $p\bar{p} \rightarrow J/\Psi X$
Long lifetime: $p\bar{p} \rightarrow b\bar{b} \rightarrow J/\Psi X$

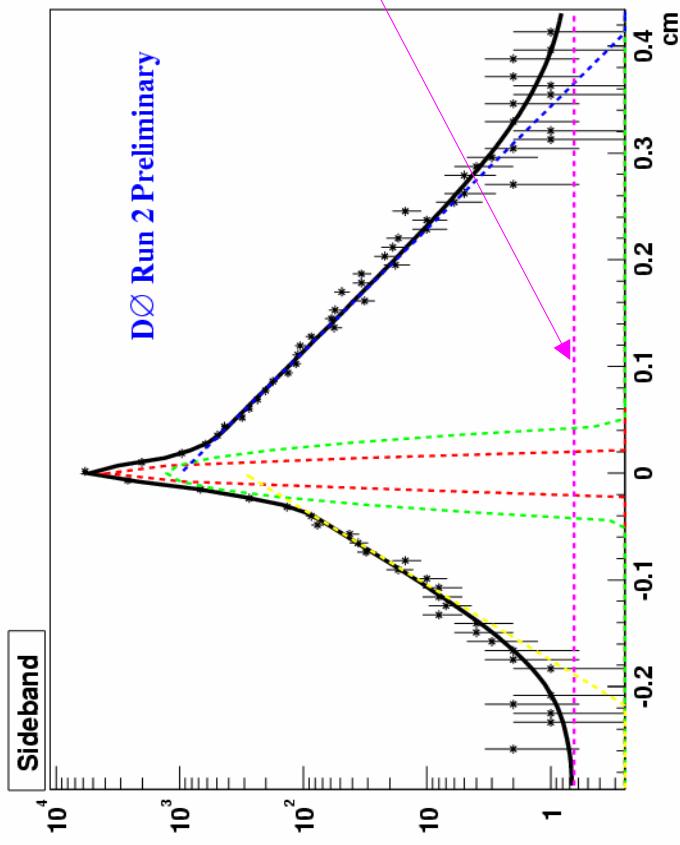
■ Background:

Zero lifetime: combinatorics
Long lifetime: semi-leptonic b and c decays

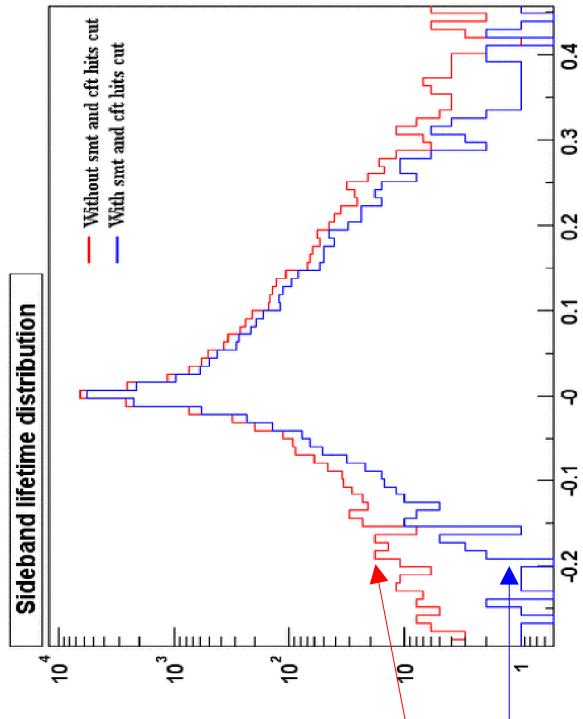




Background shape

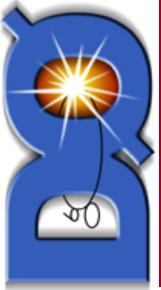


Flat background~0.3%



Without silicon + fiber tracker cuts

After silicon + fiber tracker cuts



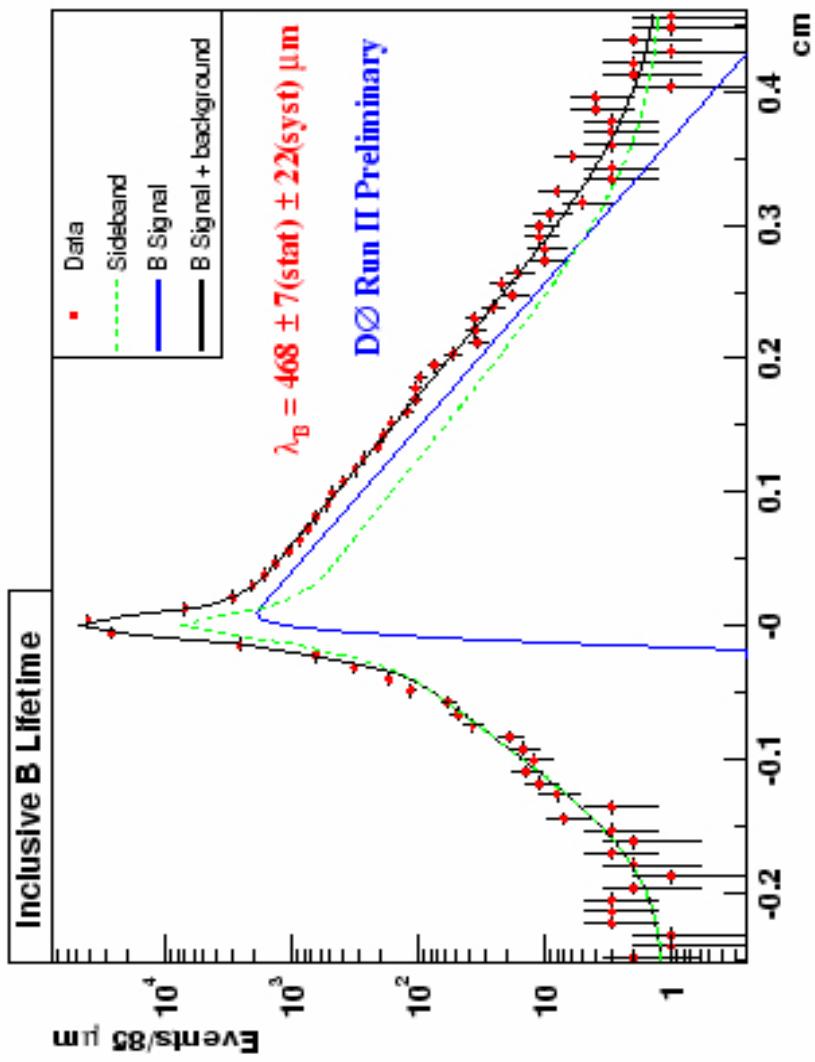
Lifetime Fit



■ Signal fractions:

B fraction: $17.3 \pm 0.5\%$
Prompt J/ ψ : $82.7 \pm 0.6\%$

■ Background: 21.3%



$$\lambda_B = 468 \pm 7(\text{stat}) \pm 22(\text{syst}) \mu\text{m}$$

$$\langle \tau \rangle = 1.561 \pm 0.024(\text{stat}) \pm 0.074(\text{syst}) \text{ ps}$$

Note: Systematic error dominated
for correction factor (16 μm)



Results, Conclusions and more...



- Measured Inclusive B Lifetime:
$$\langle \tau \rangle = 1.561 \pm 0.024 (\text{stat}) \pm 0.074 (\text{syst}) \text{ ps}$$
- Reported (PDG) Inclusive B Lifetime:
$$\langle \tau \rangle = 1.564 \pm 0.014 \text{ ps}$$
- Lifetime is consistent with PDG
- We are working on systematic errors
- We are starting to attack exclusive channels

Backup Slices

Eduard De La Cruz Burelo

APS April 2003 Meeting, Philadelphia PA



Systematic Uncertainties



Source	Uncertainty (μm)
Boost Correction	± 15.9
Background Shape	± 3.0
Flight Length dependence	± 1.1
Back. Normalization	± 0.68
Alignment bias	± 4.1
Fitting Bias	± 13
Total	$\pm 22 \mu\text{m}$